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**RESTRICTED**

**ORDNANCE PAMPHLET 1239**

**(PRELIMINARY)**

# **5"0 ROCKET**

**(5"0 MOTOR, FIN STABILIZED)**



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## **DESCRIPTION AND INSTRUCTIONS FOR USE**



**8 DECEMBER 1944**

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NAVY DEPARTMENT  
BUREAU OF ORDNANCE  
WASHINGTON, D. C.

8 December 1944

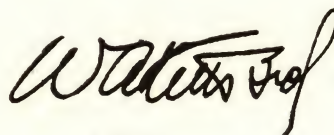
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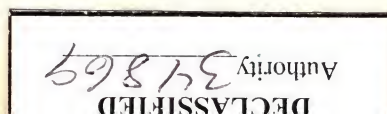
5"0 ROCKET (5"0 MOTOR, FIN STABILIZED)—DESCRIPTION AND INSTRUCTIONS  
FOR USE

1. Ordnance Pamphlet 1239 (Preliminary) describes the 5"0 Rocket (5"0 Motor, Fin Stabilized), and contains instructions for its assembly and use. The material in chapters VIII, IX, X, and XI of this pamphlet are under the cognizance of the Bureau of Aeronautics. The information in these chapters was provided by that Bureau, and is included as a convenience to the forces afloat.
2. This pamphlet is for the use of all personnel concerned with the operation and handling of the 5"0 Rocket (5"0 Motor, Fin Stabilized).
3. Because of the urgent need for this information, it has been issued in preliminary form. This pamphlet will be revised and issued in complete, final form as soon as practicable.
4. This pamphlet does not supersede any existing publication.
5. It is not intended that this publication be carried in aircraft for use therein.
6. This publication is RESTRICTED and shall be safeguarded in accordance with the security provisions of U. S. Navy Regulations, 1920, Articles 75½ and 76.

G. F. HUSSEY, JR.  
*Rear Admiral, U. S. Navy*  
*Chief of the Bureau of Ordnance*



*Acting*





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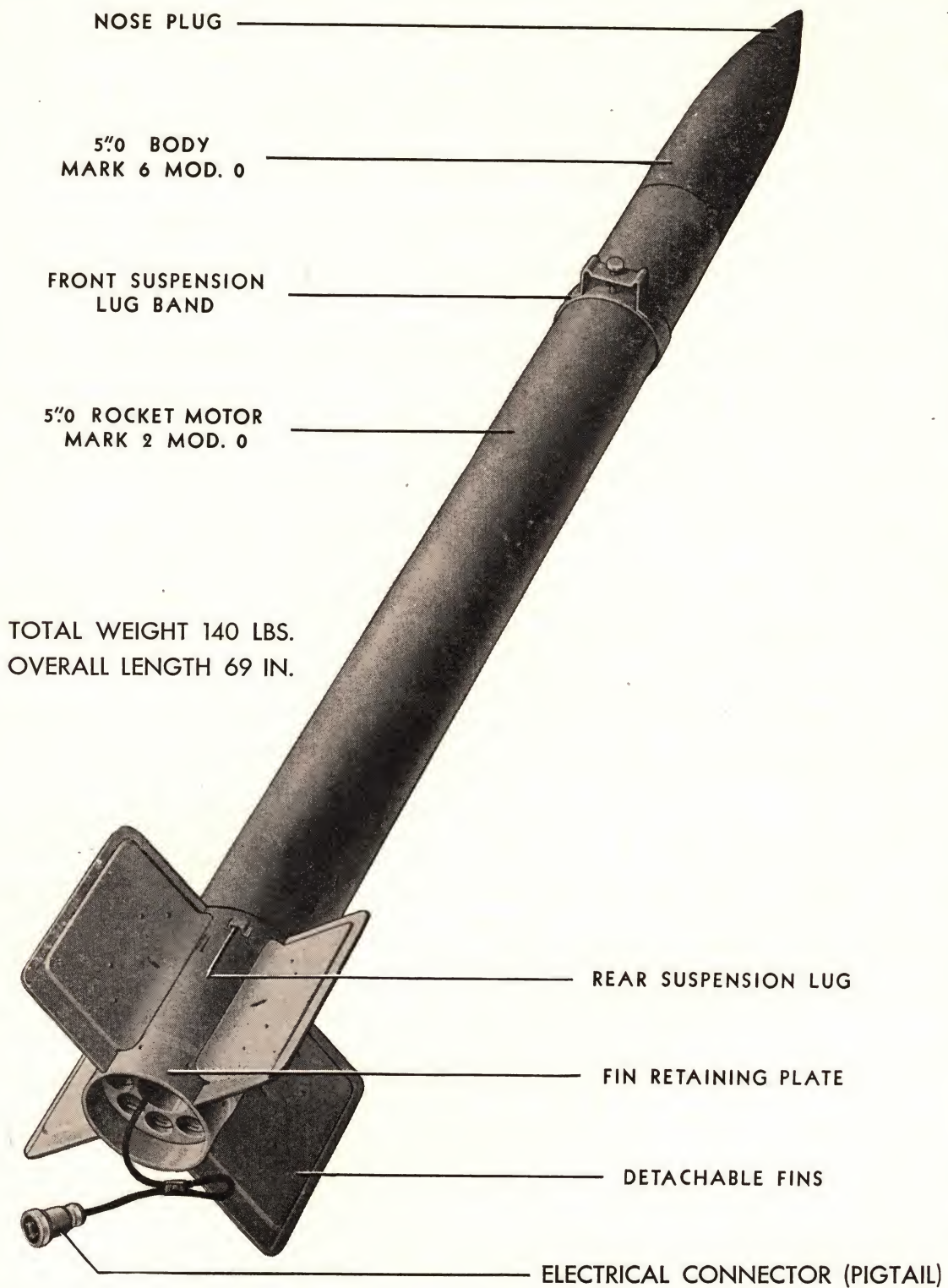


Figure 1—5'0 Rocket (5'0 Motor, Fin Stabilized)



## 5"0 ROCKET

### (5"0 MOTOR, FIN STABILIZED)

## DESCRIPTION AND INSTRUCTIONS FOR USE

### I. INTRODUCTION

1. The 5"0 Rocket (5"0 Motor, Fin Stabilizer) (Fig. 1) is a rocket for shipboard use or for forward firing from aircraft. It has approximately the same velocity and trajectory as the 3"5 aircraft rocket (with 3"25 motor). It is propelled by a 5"0 rocket motor and can be fired from Aircraft Rocket Launcher Mark 4 Mod 0, Special Zero Length Launchers, Grumman Type Zero Length Launchers, the Universal Zero Length Launchers Mark 5 and Mods and the shipboard Launcher Mk 30 Mod 0. The shipboard launcher is described in detail in OP 1135 (Preliminary). The assembled rocket is 69 inches long and weighs approximately 134 pounds.

### II. DESCRIPTION, 5"0 ROCKET MOTOR MARK 2 AND MODS

#### 1. 5"0 Rocket Motor Mark 2 Mod 0:

(a) This 5"0 Rocket Motor (Fig. 2) consists of a seamless steel tube with internal threads in both ends. Into the rear end is screwed the nozzle plate having eight nozzles arranged in a circle and a central blowout nozzle. The central nozzle is closed by a disc of 0"024 thick copper, insulated against the heat of the motor by asbestos and hard fiber plugs. The thickness of the disc is such that it shears and blows out at a pressure of approximately 2400 pounds per square inch, which is the normal maximum motor pressure when the propellant grain is at 100°F. If the pressure rises above this value, the disc and the plugs are ejected; this increases the usable temperature range of the rocket.

(b) The eight nozzles are sealed individually by light steel cups and sealing compound. One nozzle accommodates the electrical connector cable. The cup on this nozzle has a cylindrical extension which

is crimped around the electrical connector cable. In shipment, a dome-shaped steel shipping cap fits into the sleeve of the fin assembly, acting as an auxiliary seal and at the same time serving to enclose and protect the electrical connector cable and plug.

(c) Lugs for attaching the fins are mounted on the nozzle end of the motor. The fins are shipped with the motor and are attached when the round is assembled. The fins are held in place by spring loaded latches within the fin itself. The fin lugs and rear suspension lug are welded to the fin assembly which is slipped on over the nozzle end of the motor. (Drive screws hold the sleeve in place.) The front lug band is strapped to the motor.

(d) The motor as shipped is for use with the aircraft launcher Mark 5 Mod 1. An extra rail type lug band is provided in the shipping box to adapt the rocket for use on the Aircraft Rocket Launcher Mark 4 Mod 0.

(e) The front end of the motor is sealed by a front closure disc equipped with a blowout window in the center to allow easy passage of the motor gases to the pressure-arming fuze in the base of the body. A one inch thick washer is glued to the inside of the front closure disc to support the grain and to prevent the grid and grain from shifting in the motor tube. In shipment, a cylindrical metal thread protector extends into the motor to the same depth as the body and seats on one or more felt washers. The center of the thread protector is closed by a light steel cup.

(f) The propellant is a cruciform shaped grain of ballistite weighing 24 pounds. The grain is inhibited on the outer web surfaces and is supported by a spacer and steel grid at the nozzle end.

(g) The propellant is ignited by a metal case igniter containing 55 grams of black powder.



NOTE: The 5"0 Rocket Motor Mark 1 Mod 0 is the pilot production of the 5"0 Rocket Motor Mark 2 Mod 0; the two motors vary only in that the fin retaining and suspension lugs of the former are welded directly to the motor tube and the rear suspension lug of the Motor Mark 2 Mod 0 has a slightly larger opening.

2. **5"0 Rocket Motor Mark 2 Mod 1:**

(a) This design will not go into production.

3. **5"0 Rocket Motor Mark 2 Mod 2:**

(a) This motor differs from the 5"0 Rocket Motor Mark 2 Mod 0 in that the fins are welded directly to a sleeve which slides over the after end of the motor. The fin assembly is complete within itself and separate from the motor. In the 5"0 Rocket Motor Mark 2 Mod 2 the rear suspension lug for use with the Launcher Mark 5 Mod 1 is also on an independent band strapped to the tube.

(b) The fin assembly is slipped over the nozzle end of the motor and is clamped between the rear suspension lug band and a nozzle ring attached to the nozzle. The fin assembly also interlocks with projections of the lug on the rear band to prevent rotation.

4. **5"0 Rocket Motor Mark 2 Mod 3:**

(a) This 5"0 Motor, which will be issued in large quantities and will supersede the Mods 0 and 2, is similar to the 5"0 Rocket Motor Mark 2 Mod 2 except that the nozzle ring is of slightly different construction.

**III. DESCRIPTION OF 5"0 ROCKET BODY MARK 6 MOD 0**

The 5"0 Body Mark 6 Mod 0 is a modified 5"/38 AA Common Projectile. The body weighs approximately 52 pounds and is loaded with TNT. During shipping and stowage the nose fuze is replaced by a nose shipping plug. A conical nose plug was installed in place of the nose fuze on the early production. All of these bodies are fuzed with a base fuze which is permanently installed. The base fuze screws directly into the base of the 5"0 Bodies Mark 5 Mod 1 and Mark 6 Mod 0 and into an adapter on the 5"0 Body Mark 5 Mod 0. **No attempt is to be made to remove the base fuze.** A metal cup shaped shipping cap protects the base fuze and the threads on the rear end of the body. When the nose

fuze has not been allowed to arm, this body will have the fragmentation and penetration characteristics, at comparable velocities, of the 5"/38 AA Common projectiles.

**IV. FUZES**

1. The 5"0 Rocket Body Mark 6 Mod 0 is shipped with base fuze and nose shipping plug installed. When a nose fuze Mark 149 Mod 0 is to be used, the nose plug is removed and the fuze installed in its place. **No attempt is to be made to remove the base fuze.**

2. **Nose Fuze Mark 149 Mod 0:**

(a) O P 1017 presents a more complete description of this fuze, and should be consulted if more information is desired.

(b) DESCRIPTION—This fuze is an air arming, impact firing fuze used in 3"5 and 5"0 Rockets (3"25 Motor) and the 5"0 Rocket (5"0 Motor). The fuze fits directly into the nose of the 5"0 Rocket Body Mark 6 Mod 0 when the nose shipping plug is removed. In the unarmed position, the firing pin is screwed down alongside the detonator shutter holding it in a "detonator safe" position. The propeller is attached to the firing pin and is prevented from turning by the propeller locking pin which is attached to a propeller locking pellet. The cap on the nose of the fuze is held tightly in place on the gasket by a clamp assembly held together by the safety wire, or the fuze arming wire when the round is loaded on the launcher ready to fire. This cap prevents exposure of the fuze to the weather and is thrown off when the rocket is fired. A spring to throw the cap off when the arming wire is withdrawn is located under the cap and bears on the top of the propeller. This spring also aids the propeller locking pin in preventing the propeller from turning as long as the cap is secured by the safety or arming wire. When a rocket is loaded on the launcher, the arming wire is first inserted in a hole next to the safety wire in the clamp pin and bushing assembly, and then the safety wire is removed. This procedure must not be reversed or the cap will fly off exposing the propeller.

(c) OPERATION—When the rocket is fired the arming wire pulls free releasing the clamp assembly allowing the cap spring to throw off the cap, thus exposing the propeller. At the same time ac-



celeration retracts the propeller locking pin, releasing the propeller. As the propeller turns (in a clockwise direction when looking at the nose), the firing pin is drawn out and clears the detonator shutter in about eight turns. The shutter is held in a safe position by the shutter locking pin which retracts into the shutter cavity during acceleration. Therefore, arming does not occur until after the end of burning of the propellant when the shutter locking pin moves back to its original position releasing the shutter which snaps into the armed position where it is locked by a detent. The firing pin jams and stops turning when the end of the threads reaches the nose plate. Upon impact the firing pin shears the threads in the nose plate and is driven into the detonator in the shutter setting off the explosive train.

- (1) The fuze may be fired "safe" by releasing the arming wire so that it goes with the round.

### 3. Base Fuze Mark 159 Mod 0:

(a) The Base Fuze Mark 159 Mod 0 is similar in fuze action to the Base Fuze Mark 146 Mod 0 (See O P 1017), differing only in minor design details. The essential difference is in the impact firing delay. The Mark 159 Mod 0 has a fixed pyrotechnic delay of approximately 0.015 seconds.

(b) DESCRIPTION—The functioning mechanism of the fuze is contained in two pieces, the head and the body. The head contains a gas chamber formed by the plug and the diaphragm. Gases from the rocket motor are permitted to flow slowly into the gas chamber through an aperture in the inlet screw. Just beneath the diaphragm and in the body an aluminum arming plunger is held in position by a shear wire. The arming plunger holds a locking ball in such position as to lock the firing pin body and firing pin in a forward position, compressing a weak creep spring (firing pin spring).

- (1) While in the forward position, the firing pin extends through the firing pin guide holding the spring-loaded shutter in an unarmed position so that the delay detonator is out of alignment with the lead-in and the firing pin itself. A lead-in disc is housed between the shutter and the magazine which encloses the fuze cavity.

(c) ARMING—The fuze head screws into the base of the rocket body. The gasket, and luting on the threads, make a gas-tight seal in the body between the rocket motor and the interior of the rocket body. The rear end of the fuze (the exterior surface of the plug) is exposed to the front end of the rocket motor. The fuze body extends into a cavity in the high explosive in the interior of the rocket body. The fuze arms in two stages:

- (1) Gases from the rocket motor enter the pressure chamber through a small orifice in the inlet screw. Debris from the rocket motor is filtered out by the inlet washer. When the pressure in the chamber has reached a value of about 350 pounds per square inch, after about half the burning time of the propellant, the diaphragm collapses, forcing the arming plunger down and shearing the shear wire that holds the plunger in place. Movement of the plunger releases the locking ball, which, in the unarmed condition, locks the firing pin body in place, and allows the latter to move toward the rear under the force of the firing pin spring and the inertia of the firing pin body due to acceleration. The firing pin, attached to the firing pin body by a lock wire is thus withdrawn from the delay detonator shutter which it normally locks in the safe position.
- (2) When the rocket accelerates, the inertia of the shutter forces it back against the firing pin guide, compressing the shutter spring and engaging the shutter locking pin in a hole in the firing pin guide. About midway during acceleration, the firing pin is withdrawn from the shutter, but the shutter, held by the shutter locking pin, remains locked in the safe position. When acceleration is over the shutter spring forces the shutter forward against the lead-in disc, disengaging the shutter locking pin from the hole in the firing pin guide. The shutter spring then swings the shutter into the armed position (delay detonator in line with the firing pin and the lead-in), where it is locked by the detent.



(d) **FIRING**—The fuze fires by inertia of the firing pin body driving the firing pin forward against the delay detonator on impact. After striking the primer in the delay detonator, the firing pin telescopes back into the firing pin body shearing the lock wire. The fuze has a fixed pyrotechnic delay of 0.015 seconds in addition to which there is a slight delay in firing inherent in the forward motion of the firing pin body and firing pin on impact. The delay detonation initiates the tetryl lead-in and tetryl booster which detonate the main filler of the rocket directly.

## V. INSTRUCTIONS FOR ASSEMBLING THE AMMUNITION

To assemble the rocket proceed as follows:

### 1. Attach the fins to the motor.

(a) 5"0 Rocket Motor Mark 2 Mod 0—Attach four fins to the fin lugs at the nozzle end of the motor. This is done by tapping the fin downward as in Fig. 3 onto the fin lug until it seats and then tapping it backward, Fig. 4, until the rear edge of the fin is flush with the rear end of the motor and the spring latch, visible through the slots in the center of the fin, drops into place. If the fins are to be removed, insert a screwdriver into the slot in the center of the fin, raise and hold up the latch while the fin is tapped off forward.

(b) 5"0 Rocket Motor Mark 2 Mods 2 and 3—Slip the fin assembly over the nozzle end of the motor so that it interlocks with the projections on the rear rocket support loop. Tighten the nuts on the fin sleeve bolts.

2. Remove the thread protector from the front end of the motor and the loose felt washers on the outside of the front closure disc.

3. Remove the thread protector from the base of the body.

4. Screw the body into the motor, using a strap wrench to screw the body on tightly.

5. Remove the rear shipping cap of the motor which protects the electrical connector and the nozzles. This cap can be removed with a screwdriver.

**Caution:** Do not remove the shorting clip on the electrical connector plug pins at this time. The shorting clip is not to be removed until after load-

ing the rocket on the launcher and just prior to inserting the plug into the launcher receptacle.

6. Remove the nose shipping plug from the body and install the Nose Fuze Mark 149 Mod 0 being careful the Auxiliary Booster Mark 3 Mod 0 or Mark 3 Mod 1 does not fall out. DO NOT remove the fuze safety wire or ready the fuze until the rocket is loaded on the launcher.

7. Place the assembled rockets horizontally on the deck or on racks. Do not stand the rocket on its tail, as this may damage the electrical connector cable.

## VI. PERFORMANCE

1. The temperature firing limits as set on the present ammunition are determined by rocket performance in proof-firing tests. Therefore, it is important that rocket firing temperatures be kept within the limits marked on each motor. No definite temperature limits are now available to cover all 5"0 Rocket Motors.

2. The 5"0 Rocket (5"0 Motor) has a gravity drop of 8 mils less than the 3"5 Rocket (3"25 Motor) for a 20° dive, plane speed of 300 knots, slant range of 1,000 yards and a motor temperature of 70°F. The dispersion is about 8 mils laterally and vertically at an aircraft speed of 300 knots and 1,000 yards range.

3. When fired from a plane traveling at 300 knots the following performance may be expected from this rocket. Fuzed with the Nose Fuze Mark 149 Mod 0 the rocket theoretically should cause "serious damage" to armor 1½" in thickness. Serious damage implies that the minimum dimension of the hole through the plate is at least as great as the diameter of the rocket body. Against armor of this thickness, however, the fragment damage behind the plate will be small. Against thinner plates the damage, both to the plate and behind it, becomes increasingly greater. Equipped with the Base Fuze Mark 159 Mod 0 and with the nose fuze fired safe the rocket should completely penetrate armor at least one inch in thickness and detonate with maximum effectiveness a few feet behind the plate. Against reinforced concrete the Base Fuze Mark 159 Mod 0 must be used in order to inflict other than superficial damage. The nose fuze must be set safe. Fuzed thus the rocket is theoretically cap-



able of penetrating slabs of reinforced concrete (5,000 psi) 3.75 and 2.75 feet thick at normal and 30° obliquity respectively, but it is probable that the rounds will frequently break up or deflagrate before achieving maximum penetration.

## VII. AMMUNITION SHIPPING AND STOWAGE

### 1. 5"0 Rocket Motor Mark 2 and Mods:

(a) Motors are shipped in individual containers. In each box is packed an extra button type lug band. The fins for the Motor Mark 2 Mod 0 are also in the motor shipping box. The fins for the motors Mark 2 Mods 2 and 3 are shipped in separate containers and do not require special magazine stowage. The same regulations that apply to the stowage of smokeless powder apply to the stowage of rocket motors. Motors are to be stowed in the original shipping boxes in the magazines, and only such quantity as is necessary to satisfy ready stowage requirements are to be unpacked and assembled with fins.

(b) Motors are not to be located in the same compartment with or near radio apparatus or antenna leads.

(c) Until the body is secured to it, the motor is non-propulsive. The motor is shipped and stored with metal nozzle seals, a rear shipping cap, and a metal closure in the front end of the motor. These metal seals are of light construction and will blow out at relatively low pressure. If the motor is ignited the hot blast will issue from both ends of the motor and hence constitute a fire hazard. The motor can be accidentally ignited by any of the following:

- (1) By feeding electric current to the igniter. About one-half ampere at one-half volt is required to set it off.
- (2) By exposing the motor to fire or temperature above 325°F.
- (3) By subjecting the motor tube to small arms fire, or high velocity bomb or shell fragments.

### 2. 5"0 Rocket Body Mark 6 Mod 0:

(a) The body must be stowed in high explosive magazines and handled as a high explosive. The body may be removed from the shipping box. However, the thread protector shall not be removed

from the body until the ammunition is to be assembled. The body is shipped with a shipping nose plug and a base fuze installed. In no case is the base fuze to be removed from the body. The bodies may be stowed in existing 5"/38 projectile bins.

### 3. Fuzes:

(a) The Nose Fuze Mark 149 Mod 0 is packed in individual, sealed, metal containers and is to be stowed in existing fuze magazines. The Base Fuze Mark 159 Mod 0 is shipped installed in the base of the 5"0 Rocket Body. The base fuze is not to be removed from the rocket body.

### 4. Temporary Stowage:

(a) Rockets should be kept in the shade and away from direct sunlight. If rockets have been exposed to temperatures outside the safe firing temperature limits for one hour or more they must not be fired until after they have been maintained within the safe firing temperature limits for at least six hours. When fired at temperatures in excess of the upper safe limit specified on the motor tube, the generation of gases may be so rapid that they cannot escape through the motor nozzles, with the result that the motor tube will probably burst. On the other hand, if firing takes place at a temperature less than the lower safe limit, spasmodic or partial burning may occur, resulting in a very short distance of travel.

## VIII. LAUNCHERS

The following launchers are available for launching the 5"0 Rocket (5"0 Motor, Fin Stabilized):

### 1. Aircraft Rocket Launcher Mark 4 Mod 0:

(a) This is a single non-jettisonable dural rail 70 inches long, 3½ inches wide, 3⅝ inches thick at the center, and 1¾ inches thick at the forward end. The lengthwise slot on the underside of the rail supports the rocket which has two button-type lug bands. This launcher is being replaced by the zero length type launchers on all except certain VPB type aircraft.

### 2. Special Zero Length Launchers:

(a) These are streamlined, steel, zero length posts (Fig. 5) which were developed for the SB2C and F4U airplanes prior to the advent of the Mark 5 Launchers. The Forward and After posts are mounted in pairs on forward and after base plates



which may be attached to the under surfaces of the airplane wings. The fuze arming controls are mounted beside the forward posts in the base plates. The rocket connector receptacles are recessed in the base plate on which the after posts are mounted. A shear plate is provided to shear the pigtail when it is blown aft during launching. A button-type stud near the forward end of the rocket assembles in the slot on the forward post (Fig. 6); a loop type lug is employed to assemble the rocket to the after post which contains a shear wire retained latch (Fig. 7).

### 3. Grumman Type Zero Length Launcher:

(a) This launcher, now in use on Model F6F series airplanes, comprises forward and after steel posts which are attached to internal supports built into the airplane. The forward post contains a shear wire retained latch and the after post is of the fin suspension type. A button-type stud near the forward end of the rocket assembles in the slot on the forward post; the assembly to the after post is by fin suspension and the after lug is, therefore, not utilized. Since this launcher was developed for the 3"5 and 5"0 Rocket (3"25 Motors), the fin suspension on the after post must be modified by an adapter before the 5"0 Rocket (5"0 Motor) may be assembled to it.

### 4. Universal Zero Length Launcher Mark 5 and Mods:

(a) This launcher has been selected as the standard launcher for all carrier based aircraft, and it will replace all other types. This launcher comprises four dural after posts mounted on a base plate and four dural forward posts mounted on a base plate. (These may be mounted integrally or cut in sections as required to accommodate aircraft structure). These base plates are attached at suitable points on the undersurface of each wing. The rocket is assembled to the forward post with a button-type stud and attachment to the after post is by means of a loop type lug. The fuze arming control is built into the forward post and a latch and pigtail receptacle are built into the after post.

(b) The Launcher Mark 5 Mod 0 was never issued to the service. The Launcher Mark 5 Mod 1 (Figs. 8 and 9) has been used successfully for launching the 3"5 and 5"0 Rockets (3"25 Motor) and the 5"0 Rocket (5"0 Motor). The Launcher

Mark 5 Mod 2 incorporating improvements is now in production. The major changes in this launcher as compared with the Launcher Mark 5 Mod 1 are an increase in the wall thickness of the posts from .064 to .081 inches, taper of the latch tongue on which the lug loop is suspended, and a 0"5 increase in the length of the slot in the forward post.

(c) The Launcher Mark 5 Mod 3 which went into production in September 1944, contains a spring operated latch which is actuated by a lanyard attached to the rocket motor pigtail. This latch will soon be available for retroactive installations in all Launchers Mark 5 Mods 1 and 2. The spring operated latch eliminates the necessity for shear wires.

### 5. Shear Wire:

(a) The standard shear wires furnished with the ammunition are the only shear wires authorized for use. The wires (Fig. 7) are: (1) No. 12 medium-hard drawn (Spec. ASTM-B-2-39) copper wire which is presently supplied and (2) No. 10 soft or annealed (Spec. 22W-9) copper wire which will replace the above as soon as it is available. Either of these standard shear wires is satisfactory for use with the 5"0 Rocket (5"0 Motor). These shear wires should be used in all type launchers except the Grumman type zero length. Unauthorized shear wires should never be employed with the 5"0 Rocket (5"0 Motor) since this rocket cannot be retained safely during arrested landings with shear wire type latches. Use of stronger shear wires will result in over stressing the launcher installation and the airplane structure when the rocket is fired. In the case of emergency landings occasioned by misfires, the deck should be properly cleared to prevent injury to personnel.

(b) With the Grumman type zero length launcher (shear wire on forward post) a 3/32 inch stainless steel welding wire should be used when arrested landings are contemplated. The standard shear wire should be used at all other times.

### 6. Bore Sighting:

(a) The sight and launchers should be set parallel to the boresight datum line. It is not necessary to boresight the zero-length type launchers as was required with the Launcher Mark 4. Initial installations parallel to the boresight datum line  $\pm 1\frac{1}{2}^\circ$  have proved sufficient.



## IX. STATION DISTRIBUTORS AND ROCKET SELECTOR SWITCHES

1. Service aircraft with rocket installations may be equipped with Station Distributors Mark 2 Mod 0, 1, 2, 3, 4 or 5, Mark 3, Mark 3 Mod 1 or Mark 4. Designs prior to the Mark 2 Mod 4 are unsatisfactory, and sufficient quantities of the Mark 3 and Mark 3 Mod 1 are now available to replace the unsuitable items. Features of the Mark 3 (Fig. 10) and Mark 3 Mod 1, which are now standard, are an on-off switch, a "safety" plug, an arming switch, and a selection of single or automatic stepping between stations. The Mark 3 can be adjusted for an automatically controlled stepping interval of 0.1, 0.2, 0.3 sec., while the Mark 3 Mod 1 can be used at only 0.1 sec. when set on "auto". The Mark 4 has no provisions for automatic spacing of firing.

2. The Rocket Selector Switch Mark 1 is the newest design of equipment for the selecting of rocket fire. The switch will be used in airplanes having manufacturer installed rocket launchers but not in kits for retroactive installations. The design was based on data obtained from service experience. The mechanism is mounted on a face the size of a standard instrument case and may be installed on the instrument panel where space permits. Provisions for selecting a firing order of "pairs", "2-2-4", "2-6", or "salvo" are incorporated. The switch may be quickly reset to salvo when preset for any other combination. Stepping between stations is accomplished as rapidly as the trigger switch is closed and released. Other necessary switches are mounted in the armament switch panel.

## X. CIRCUITS AND SWITCHES FOR ROCKET ARMAMENT

1. Carrier type aircraft may have an independent rocket firing switch mounted on (1) the throttle, (2) on a bracket near the throttle, or (3) in some other position accessible to the pilot's left hand, or (4) may employ either the gun firing or bomb release button with a selector switch to energize the rocket circuit. Standard practice for new installations will be to fire rockets with the bomb release button and to transfer control from bombs to rockets by means of a "bomb-rocket" selector switch (Fig. 11). VPB type aircraft have an independent rocket firing switch mounted on the control yoke.

2. The standard schematic circuits for both the Station Distributor Mark 3 (and Mods) and the Rocket Selector Switch Mark 1 are illustrated by Bureau of Aeronautics Drawing No. R-311-D (Figs. 13 and 14).

3. Various deviations from the standard wiring may be encountered in service. Installations with an independent rocket firing switch generally do not utilize the master armament switch but rely upon the on-off switch and "safety" plug in the station distributor to break the rocket circuit. Model TBM airplanes with contractor installed provisions for Mark 4 (rail type) rocket launchers are wired to fire rockets by means of the gun trigger switch. Camera relays have not been used in retroactive installations; gun camera control is transferred to the rocket circuit by means of a camera selector switch when such a switch is installed. Pictures can also be obtained by firing guns simultaneously with rockets.

## XI. ROCKET LAUNCHER TESTING DEVICES AND PROCEDURE

### 1. Circuit Testing Devices:

(a) The circuit testing devices now in service include the Circuit Test Kits Models I, Circuit Test Kit Model II (Fig. 12), the Circuit Test Plug Model I (Fig. 12), and various "home-made" devices.

(1) The Test Kit Model I was designed to test the function and continuity of the rocket circuit; a limited quantity was made, and it has been supplanted by the Test Plug Model I. The latter is a compact plastic plug with a 26 volt light bulb and an electrical plug to match the rocket launcher receptacle.

(2) The Test Kit Model II was designed to test for stray, low voltage in the launcher circuit and to provide an auxiliary means for testing the bulbs in the test plugs. It consists of a case containing a low voltage light bulb, 5 pencil type flash light cells, a resistance, a receptacle, and a switch, and a short electrical lead with a plug to fit the launcher receptacles. As a safety measure, the socket on the case was designed to allow the electrical plug of the test kit to make contact with the battery through the resistance but to prevent the shorter pins of a rocket pigtail plug from reaching the battery cir-



cuit in case a rocket is inadvertently plugged into the test kit. The extra long pins of the test plug will reach a switch within the test kit thereby shorting out the resistance and allowing the full  $7\frac{1}{2}$  volts of the battery to light the test plug.

## 2. Circuit Testing Procedure:

(a) The procedure for testing rocket circuits specified in the past can be appreciably simplified resulting in a saving of time and an increase in safety. The practice of testing circuits for continuity immediately before loading and on the flight line should be discontinued. Continuity tests need be performed on rocket circuits only as often as performed on other armament circuits during normal operation or after unloading rockets when misfires have occurred. **Continuity tests should never be made with rockets loaded on the launchers.**

(b) TO PERFORM A CONTINUITY TEST PROCEED AS FOLLOWS:

- (1) Inspect and verify that there are no rockets loaded on launchers.
- (2) Insert one test plug into each rocket launcher receptacle.
- (3) Close all necessary switches.
- (4) Actuate the rocket firing switch.
- (5) Verify that the test plugs light in the proper sequence by checking the test lights with each setting of the station distributor or rocket selector switch.

(c) **The Following Safety Test Must be Performed Immediately Before Plugging the Rocket Pigtails into the Launcher Receptacles.**

- (1) Verify that the master armament switch is off and that the safety plug is removed; (safety plugs are used with station distributors but not with rocket selector switches).
- (2) Plug the Launcher Test Kit Model II into each launcher receptacle in turn and observe that the bulb does not glow.
- (3) **Insert the test kit plug into the test kit receptacle to check the functioning of the test kit bulb. If the bulb fails to glow when plugged into the launchers but lights when plugged into the battery circuit of the test kit, the launchers are**

free of dangerous stray voltage; the rocket pigtails may then be plugged into the launchers.

- (4) If the bulb glows when plugged into the launcher or fails to glow when plugged into the battery circuit of the test kit, **do not plug in pigtails.** In the former case, follow procedure (f) below; in the latter case, follow procedure (a) through (f) below:
- (a) Replace the bulb in the test kit circuit with the spare that is provided with each kit.
- (b) Test the functioning of the new bulb by inserting the test kit plug into the test kit receptacle.
- (c) If the bulb fails to glow, the test kit is defective, and the entire safety test should be repeated with a new test kit.
- (d) If the bulb glows when tested, the entire test procedure should be repeated, carefully watching the bulb.
- (e) If the bulb is observed to glow or to burn out when plugged into the launchers, or if the bulb again fails to glow when the kit is checked at the end of the test procedure, the plane is unsafe to carry rockets.
- (f) Unload rockets and restrict the plane from carrying rockets until such time as the launcher circuits can be checked and the stray current eliminated.

NOTE: Any tester employing a light bulb rated at 2 volts or less can be satisfactorily used. The recommended bulb is Mazda 351.

## XII. PROCEDURE FOR LOADING AND UNLOADING THE AIRCRAFT LAUNCHER MARK 5 MOD 1

### 1. Preparation for Loading the Ammunition:

(a) **SAFETY OFFICER AND CREW**—One member of the loading party, designated as the safety officer, shall be responsible for enforcing all safety precautions. Loading shall be done by qualified personnel.

(b) **CAMERA LOADING**—When a camera is to be used, the camera men shall load the camera and wind the films into position before ammunition is brought up to the airplane.



(c) **SWITCH PRECAUTIONS**—Before the rockets are loaded the **safety officer** shall turn off the following switches: (1) Main battery switch, (2) Master armament switch, (3) Rocket power switch on the station distributor, and remove the safety plug if used.

(d) **EQUIPMENT PRECAUTION:**

Inspect all launchers and insure that:

- (1) All fittings are secure.
- (2) Studs and stud parts are not damaged.
- (3) No obstructions foul the stud slots or latch mechanisms.
- (4) All moving parts are in working order.

If the safety officer believes that the launchers are unsafe for use, he must notify the pilot and obtain instructions before allowing loading operations to proceed.

## 2. Loading the Launcher:

(a) The safety officer shall authorize the loading to begin after he has checked that the airplane has been properly positioned and that unauthorized personnel have been cleared away from the aircraft. If the pilot is in the airplane the safety officer should notify him that loading operations are to begin. To load the launcher proceed as follows:

- (1) Fit front lug button and the rear lug loop into the front slot (Fig. 6) and rear tongue (Fig. 7) of the launcher respectively.
- (2) Insert the shear wire through the latch on the rear launcher post as soon as the round is in place and bend the shear wire down on both sides to prevent its coming out.  
**Note:** Use only the shear wire supplied.
- (3) Insure that the round is firmly held by trying to push it forward and rearward. **DO NOT PLUG IN THE ELECTRICAL CONNECTORS;** let them hang loose. Do not remove the shorting clips.

(b) After loading the rocket firmly into place but before plugging in the firing cable, perform the following additional steps.

- (1) Inspect cap and clamp assembly on the nose of the Fuze Mark 149 Mod 0 for corrosion. If the cap and clamp are badly corroded, it is best not to use the fuze. If corrosion is slight, grasp the clamp and

rotate it around the fuze body until it slides freely. To prevent corrosion and icing, cover the clamp assembly with a light coat of vaseline.

- (2) Turn clamp so that clamp pin and bushing are on the same side of fuze as the arming wire. Insert the arming wire into the hole which is provided next to the safety wire and then remove safety wire. **Do not** reverse this order. Save safety wire for reinsertion if the round is returned to stowage.
- (3) Insert the arming plate on the end of the arming wire into the Fuze Arming Control.
- (4) Put **one** Fahnstock clip on the end of the arming wire and slip it down against the clamp bushing. Adjust the clamp so that there is just enough slack in the arming wire between the solenoid release and the fuze to insure that the plate is not pulled part way out of the catch in the arming wire release.
- (5) Cut off excess arming wire, leave 3 or 4 inches sticking out in front of the fuze, and dress off the burrs.

3. **Final Steps after Loading:** The pigtails of the ammunition are not plugged in until after the launcher circuit has been checked with the Rocket Launcher Circuit Test Kit Model II to see that the circuit is dead as follows:

(a) The Circuit Test Kit shall be checked to see that the bulb is not burned out.

(b) The plug of the Circuit Test Kit Model II shall then be inserted successively in all launcher receptacles. It must not light in any of these tests.

(c) The Circuit Test Kit shall then be checked to make sure that the bulb has not burned out or been damaged in the above operation.

(d) The ordnance man shall then remove the shorting clip from the electrical connector and plug in the electrical connectors of each round consecutively from inboard out. While plugging in the electrical connectors, he must not stand to the rear of any of the rockets being plugged in or already plugged in. Shorting clips should be saved for future use in case the round is not fired.



(e) When the loading is complete, the master armament switch and rocket power switch on the station distributor are still OFF. The camera switch may be set on the ON position and the station distributor set so that the "Next Station" dial reading is "1". This is accomplished by pulling the "Reset Knob" and turning until the figure "1" appears in the window.

4. **Unloading:** The safety officer shall observe the same safety precautions as in loading the launcher. The loading crew shall unload the rounds as follows:

(a) Remove the electrical connector plug and replace the shorting clip.

(b) Reinsert the safety wire for the nose fuze.

(c) Inspect the fuze to see that it is dry. Dampness will corrode the working parts of the fuze.

(d) Remove the arming wire. **Do not** remove the arming wire before inserting the safety wire.

(e) Remove the launcher shear wire.

(f) Slide the round out forward, one man supporting the body and one the motor.

(g) Disassemble the ammunition or put the ammunition in ready-stowage.

If the rounds are left on the airplane, perform only steps (a) and (b) above. Under these circumstances inspect the fuze frequently and, if possible, protect the fuze and igniter cable assembly from exposure.

NOTE: Loading or unloading ammunition on the Aircraft Launcher Mark 4 is the same as for the Aircraft Launcher Mark 5 Mod 1, after a rear button type lug band is strapped to the motor. A spare button type lug band is packed in the motor shipping box for this purpose.

### XIII. SUB-CALIBER ROCKETS FOR 5"0 ROCKET (5"0 MOTOR)

1. At the present time there is no sub-caliber rocket that will give the same trajectory as the 5"0 Rocket (5"0 Motor). For purposes of aircraft training, however, an exact fit between trajectories of training rounds and standard rounds is not necessary. The techniques of accurate fire can be learned by using any round when appropriate sighting tables are available. After the pilot has learned to put the center of impact of the training round (2"25 Rocket (sub-caliber aircraft)) into the target by adjusting

his actual attack conditions to those laid out, he should also attempt, by proper flying, to reduce the overall dispersion to the inherent dispersion of the training round.

2. For details concerning 2"25 Aircraft Rockets (Sub-Caliber) refer to Ordnance Pamphlet 1187.

### XIV. GENERAL SAFETY PRECAUTIONS

1. **Duties of Safety Officer:** It is advisable to appoint one man to be in charge of safety precautions. He should be familiar with all safety rules regarding the handling and loading of rockets onto planes. He should also know the nature and construction of rockets and the equipment used to fire them from planes—the circuits, switches, launchers, etc. The following instructions summarize the duties of the safety officer:

(a) See that loading area is safe for the entry of planes.

(b) Obtain the safety plug at once, keep it in his possession or in plain sight of all hands and out of its socket. If there have been no misfires proceed as outlined in Section XII. If there have been misfires from the previous flight supervise the immediate removal of the rocket or rockets.

(c) Proceed with a thorough inspection of all rocket gear on the plane.

(d) Reinsert the safety plug in its socket and give permission to camera man or others to do all testing which must be done with safety plug in place.

(e) Obtain safety plug from cockpit and check to see that all switches are open and that rail selector switch is on "1". Keep safety plug in plain sight during loading operation.

(f) See that rockets are delivered safely to loading area, removed from conveyance and loaded on the launcher. See that the loading crew remains out of the fore and aft line with the rockets as much as possible.

(g) See that rounds are not plugged into the launcher until all other necessary operations such as insertion of fuze arming wires and shear wires are completed.

(h) Inspect shear wire to see that it is through the shear lever and that the lever hook is down in front of the lug band button. Also, inspect fuzes to see if arming wire is properly secured and if safety wires are removed.



(i) A new wire must be used after each flight. Medium Hard No. 12 gauge copper wire (Spec. ASTM-B-2-39) or No. 10 soft or annealed (Spec. 22W-9) copper should be used.

(j) If two or more planes are to be loaded and fuzed at once, there should be a separate safety officer for each plane. If this is not possible, the safety officer should obtain all safety plugs and stand where all operations on airplanes are plainly visible to him.

(k) In case of trouble in launcher or camera circuits, all rounds should be removed from the launchers on both sides before any testing is done.

(l) Rocket circuit continuity tests should be performed with the Launcher Test Plug only as often as performed on other armament circuits during normal operations or after unloading rockets when misfires have occurred. Arming solenoids should be checked at the same time.

(m) In warm weather, safety officers should see that thermometers are placed on at least one rocket of each load ten minutes or more before loading and he should note the temperatures. If this temperature exceeds the safe temperature limits marked on motors or boxes, rockets should not be loaded until they are cooled long enough to insure their being below this limit. (For AR motors two to three hours are required.)

(n) Smoking should not be permitted in the loading area within 200 feet of **any** ammunition.

(o) Planes should not be fueled while the rockets are present or on the launchers.

(p) The loading area should be inspected to determine in which direction planes should be pointed while loading. This should be the direction in which least damage to persons or property would be caused by a premature firing.

(q) Parking of armed planes on the flight deck for an extended period is not permitted except for planes which are to be used the same day or which are for ready use. Electrical connectors are to be left disconnected with the shorting clips in place.

(r) Stowage of assembled rockets other than in the ready-service compartment is prohibited. Do not stand the assembled rocket on its tail, since this may damage the electrical cable.

(s) Arming planes on the hangar deck is not recommended. Loading of the planes on the hangar

deck is permitted at the discretion of the commanding officer when necessitated by operational requirements.

IN ANY OPERATION INVOLVING FUZING, UNFUZING, ASSEMBLY, DISASSEMBLY, CLEANING, PAINTING, ETC., OF ALL TYPES OF MUNITIONS, THE WORK SHALL BE ACCOMPLISHED IN THE MOST SUITABLE LOCATION, TAKING INTO ACCOUNT SAFE REMOVAL FROM OTHER EXPLOSIVES AND POSSIBLE DAMAGE TO VITAL INSTALLATIONS, AND SHALL INVOLVE EXPOSING THE SMALLEST NUMBER OF ROCKETS PRACTICABLE. ONLY THOSE PERSONS ACTUALLY ESSENTIAL FOR THE WORK SHALL BE IN THE VICINITY. THE IDEAL SITUATION WOULD BE THAT WHERE WORK WOULD BE PERFORMED ON ONLY ONE ROCKET AT A TIME, IN A LOCATION ON DECK, REMOTE FROM ALL MAGAZINES, FROM READY STOWAGES, FROM OTHER SUPPLIES OF AMMUNITION OR EXPLOSIVE, AND FROM VITAL INSTALLATIONS.

**2. Instructions to Pilots:** The following suggestions are made for the safety of the pilot and the crew:

(a) Taxi plane to the loading area and face it in the direction designated by the safety officer.

(b) See that all switches are off, including master armament switch, AR power (ON-OFF) switch, and that the safety plug has been removed from the Station Distributor. Set rail selector switch on "1".

(c) When leaving the plane give the safety plug to the safety officer. (NOTE: A convenient method is to tie the safety plug on a cord inside the cockpit and then hang it outside the cockpit where it is in full view of the safety officer and the loading crew. This prevents mislaying of the safety plug.)

(d) On entering the plane and taking off do not put the safety plug into the socket or turn on the arming switch until near the target area.

NOTE: If it is necessary to supervise work on the plane, keep well away from front or rear of any loaded rounds. The safety officer should stand by. No testing or repair work which involves operating switches in cockpit should be done until the rounds are unloaded from launchers.



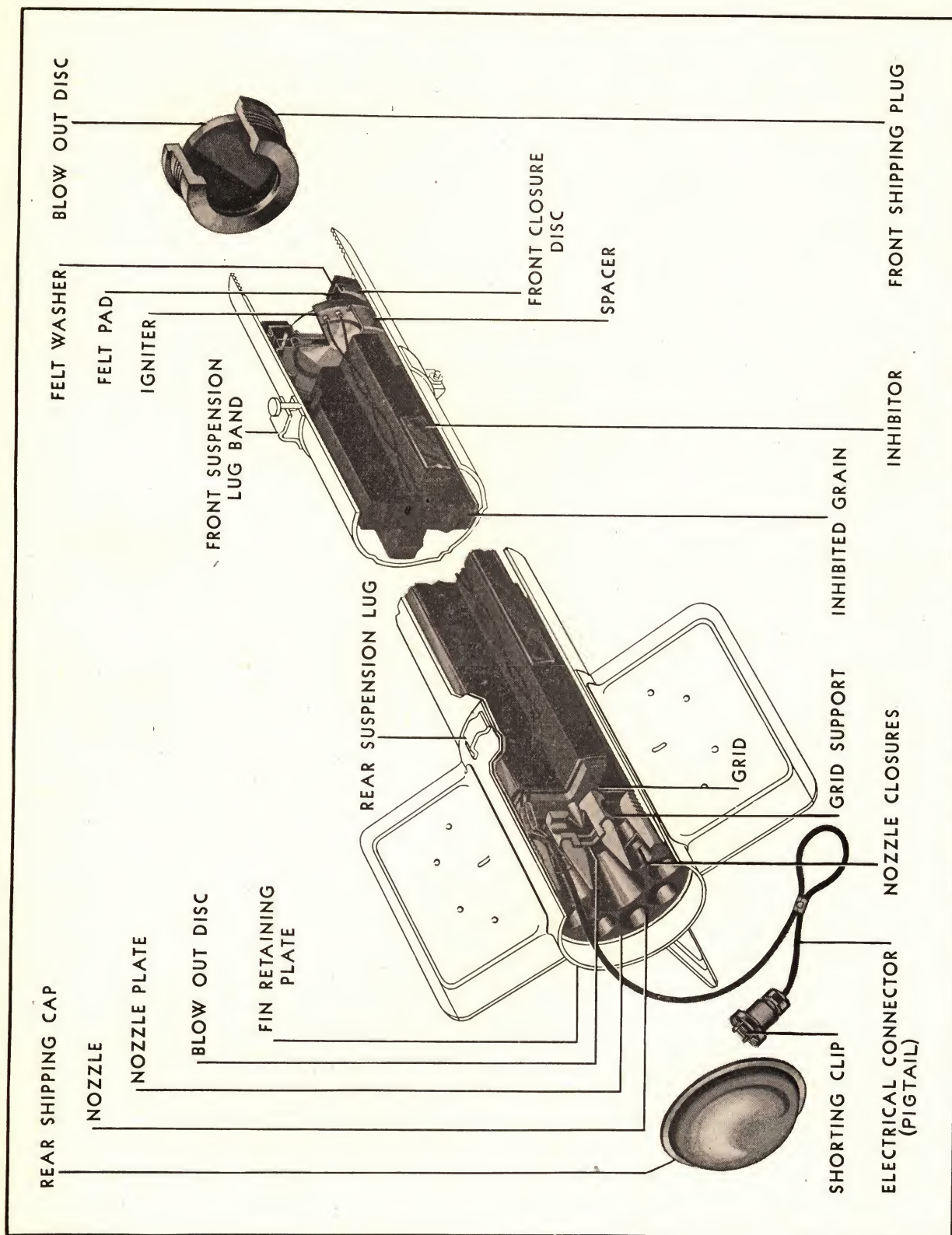
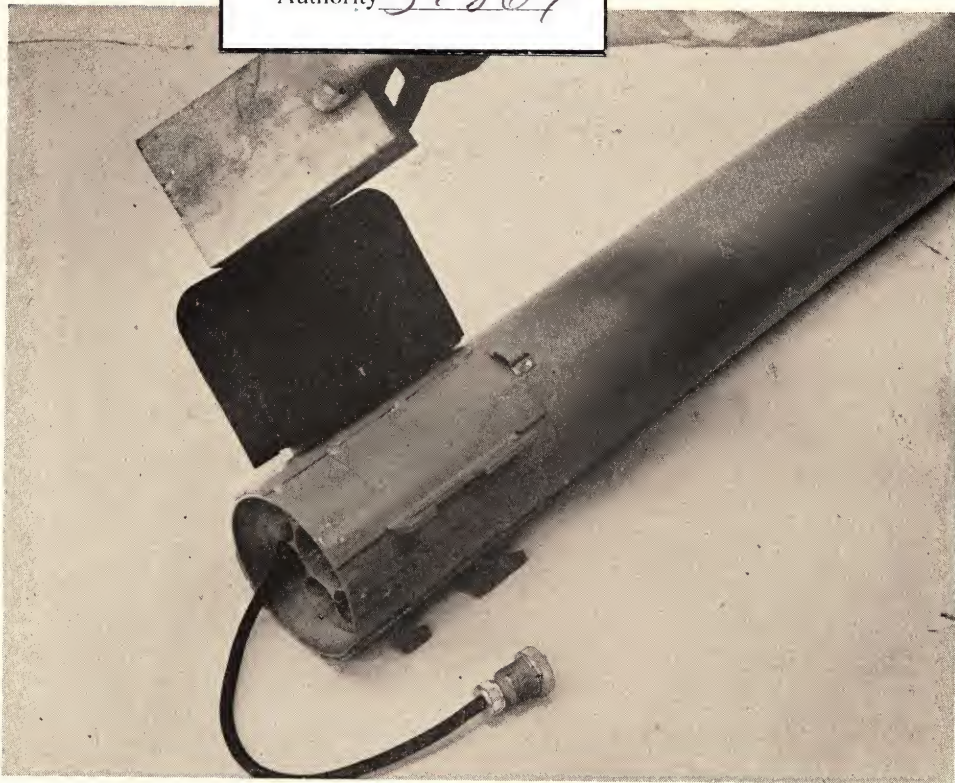
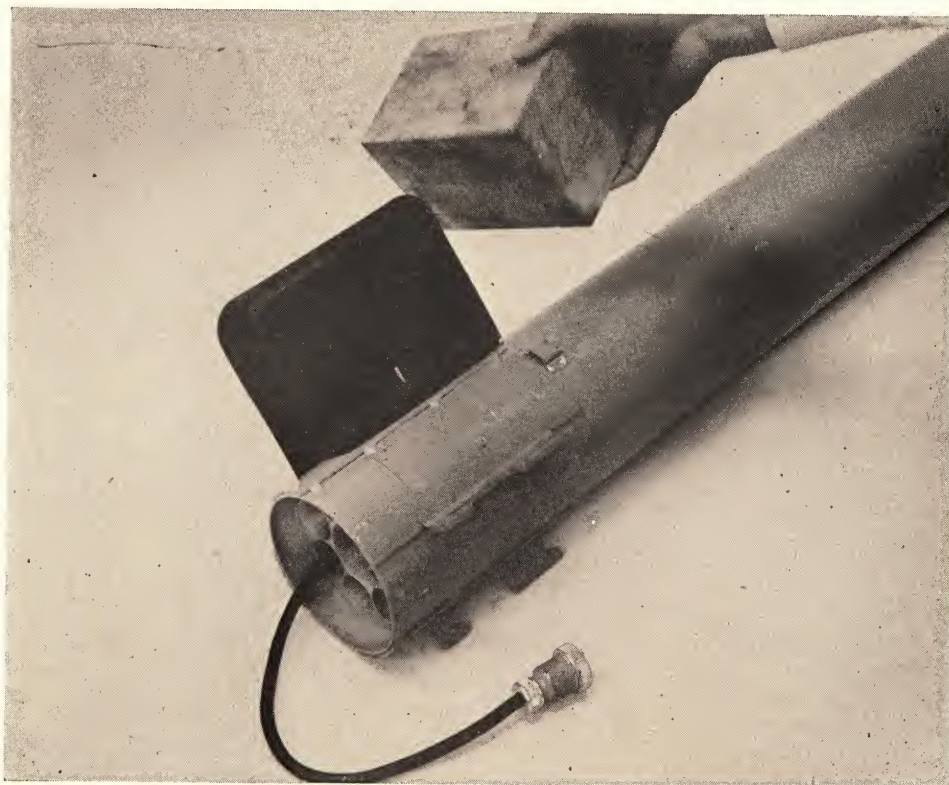


Figure 2—5'0 Rocket Motor Mark 2 Mod 0





**Figure 3—Attaching Fin to Motor—Tapping Fin Downward**



**Figure 4—Attaching Fin to Motor—Tapping Fin Backward**

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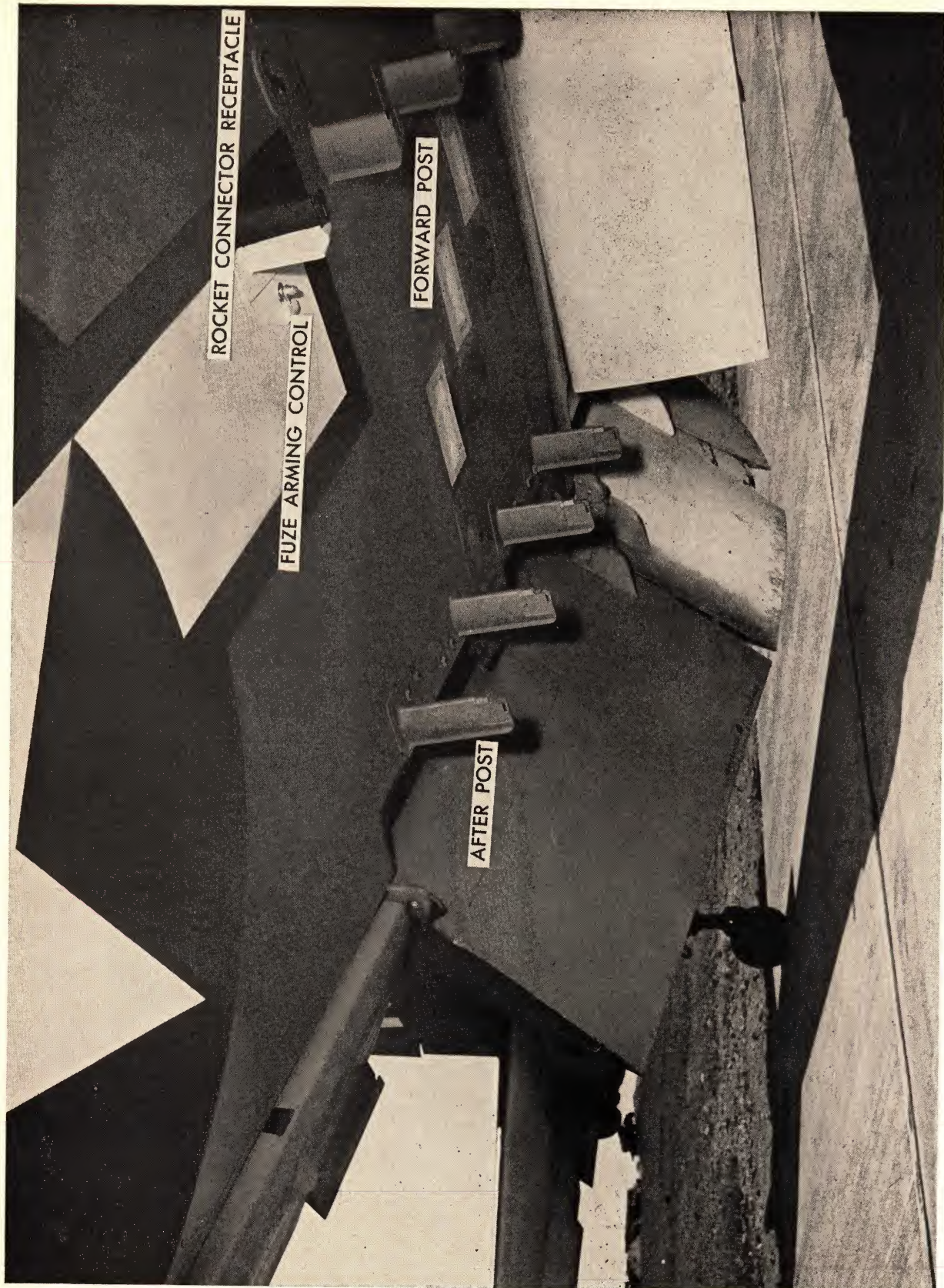
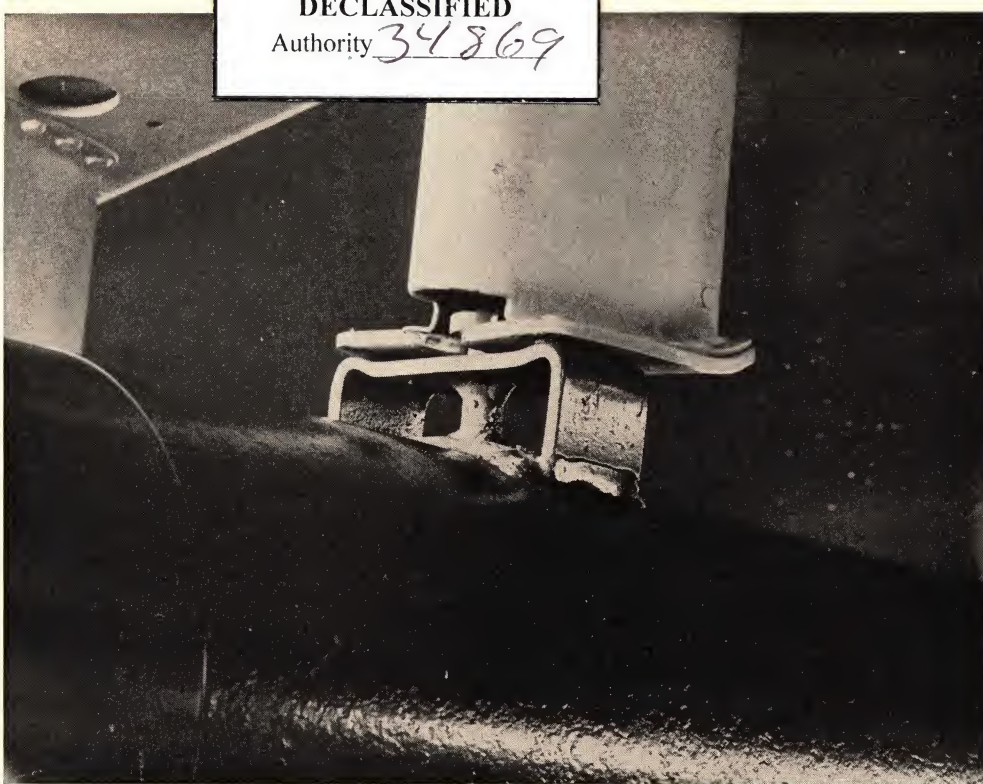


Figure 5—Zero Length Launcher. Special Steel for SB2C and F4U





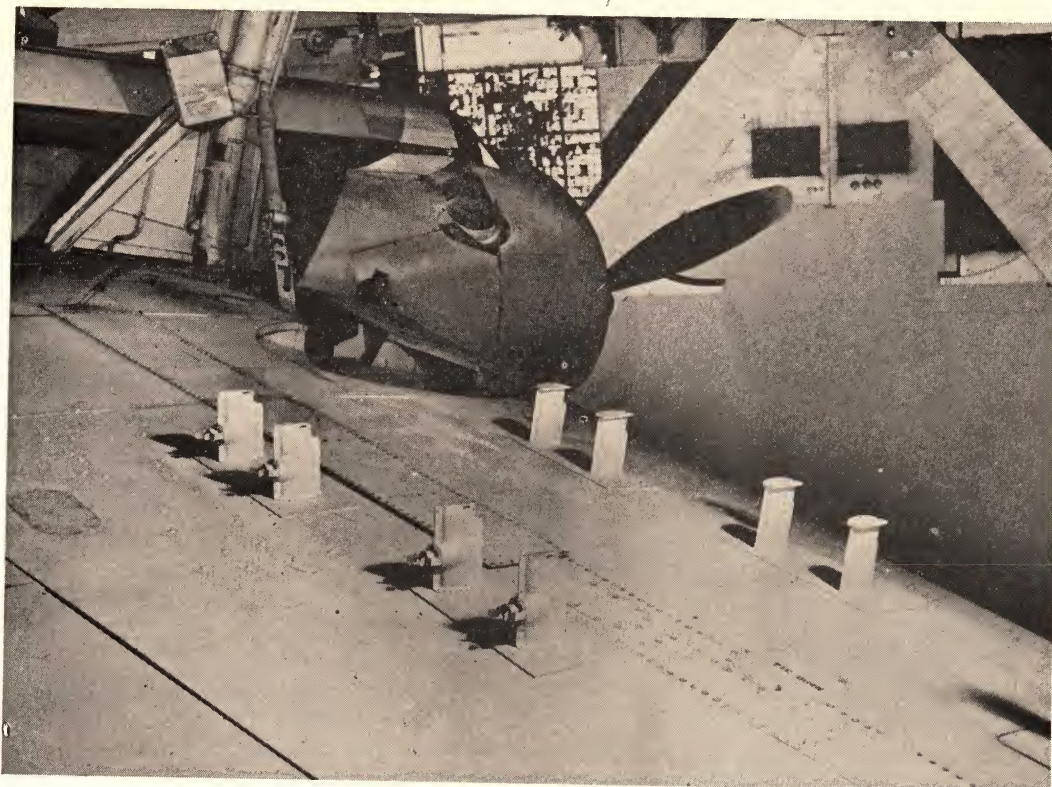
**Figure 6—View of Rocket Supported by Forward Launcher Post**



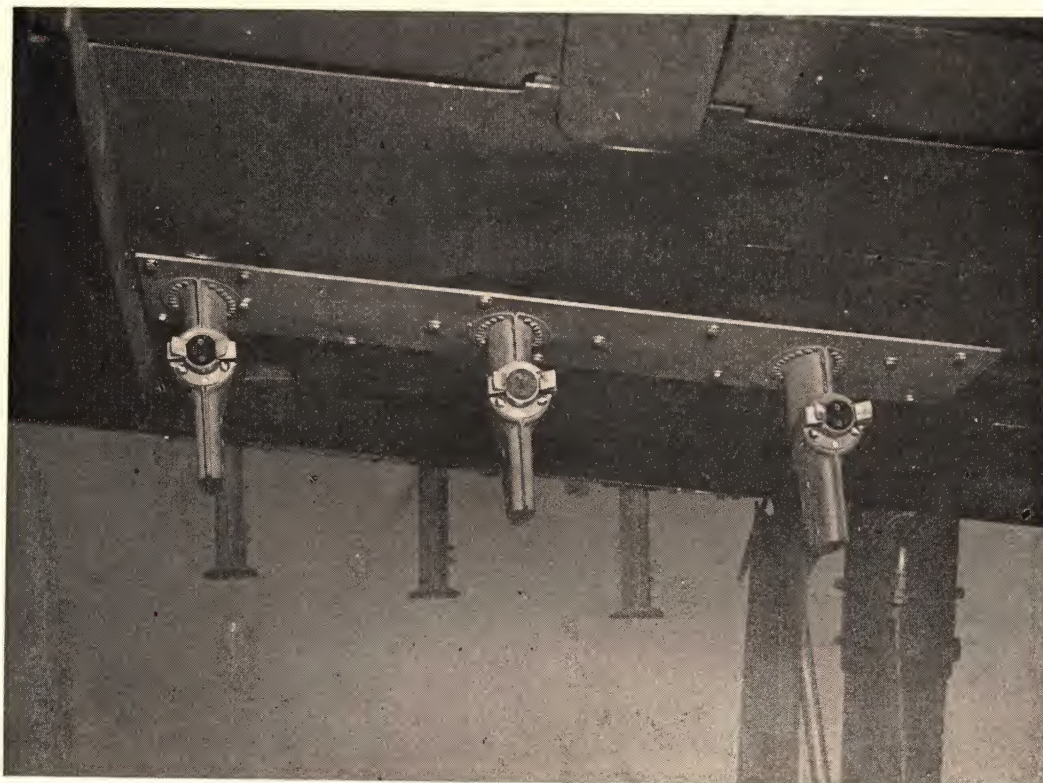
**Figure 7—View of Rocket Supported by After Zero Length Launcher Post  
(Shear Wire in Place)**

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**Figure 8—Zero Length Rocket Launcher Mark 5 Mod 1**

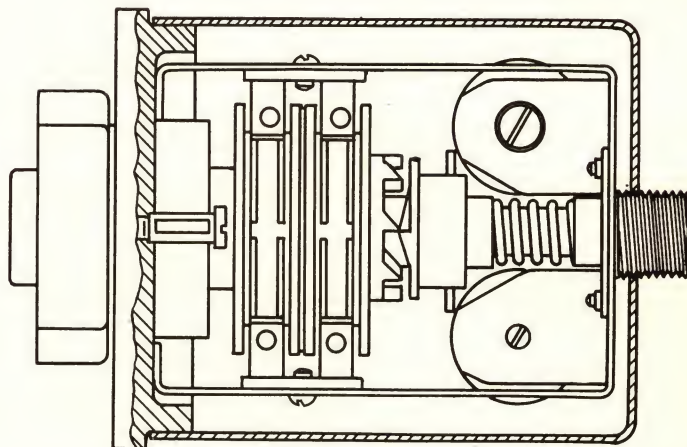


**Figure 9—Zero Length Rocket Launcher Mark 5 Mod 1  
(Showing the Electrical Connector Receptacle on the After Post)**





**Figure 10—Station Distributor Mark 3 Showing Safety Plug in Place**



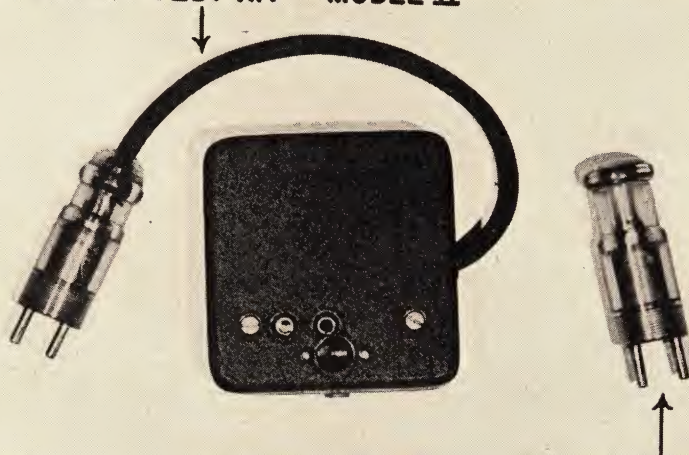
LEFT HAND VIEW OF EXTERIOR

PLAN VIEW OF INTERIOR

**Figure 11—Bureau of Aeronautics Rocket Selector Switch Mark 1**



ROCKET LAUNCHER CIRCUIT TEST KIT—MODEL II



APPROX. 1/2 ACTUAL SIZE

ROCKET LAUNCHER CIRCUIT TEST PLUG—MODEL I



Figure 12—Rocket Launcher Test Kit and Circuit Test Plug

NOTES

1. ALL ROCKET WIRING SHALL CONFORM TO DRAWING CATION NAVJEW-51-121 INSTALLATION SPECIFICATION FOR ROCKET PROJECTILE WIRING.
2. SELECTOR SWITCH AX30233OR38-13 FOR THE PURPOSE OF SELECTING EITHER BOMBS OR ROCKETS ON AIRPLANE PROVIDED WITH INTERVALMETERS AND RACK SELECTOR SWITCH AX30233OR38-13 FOR AIRPLANE PROVIDED WITH INTERVALMETERS.
3. WHERE REMOTE BOMB, TORPEDO AND ROCKET IS PROVIDED, LOCATED NEAR THE DESIRED POINT OF CONTACT, THE REMOTE BOMB, TORPEDO AND ROCKET IS PROVIDED.
4. FOR USE OF TYPE OF AIRPLANES NOT PROVIDED WITH COMBOMB RELEASE AND ROCKET LAUNCHING SWITCHES, FROM BOMB TO ROCKET SELECTOR SWITCH SHOWN IN FIG 1-14.

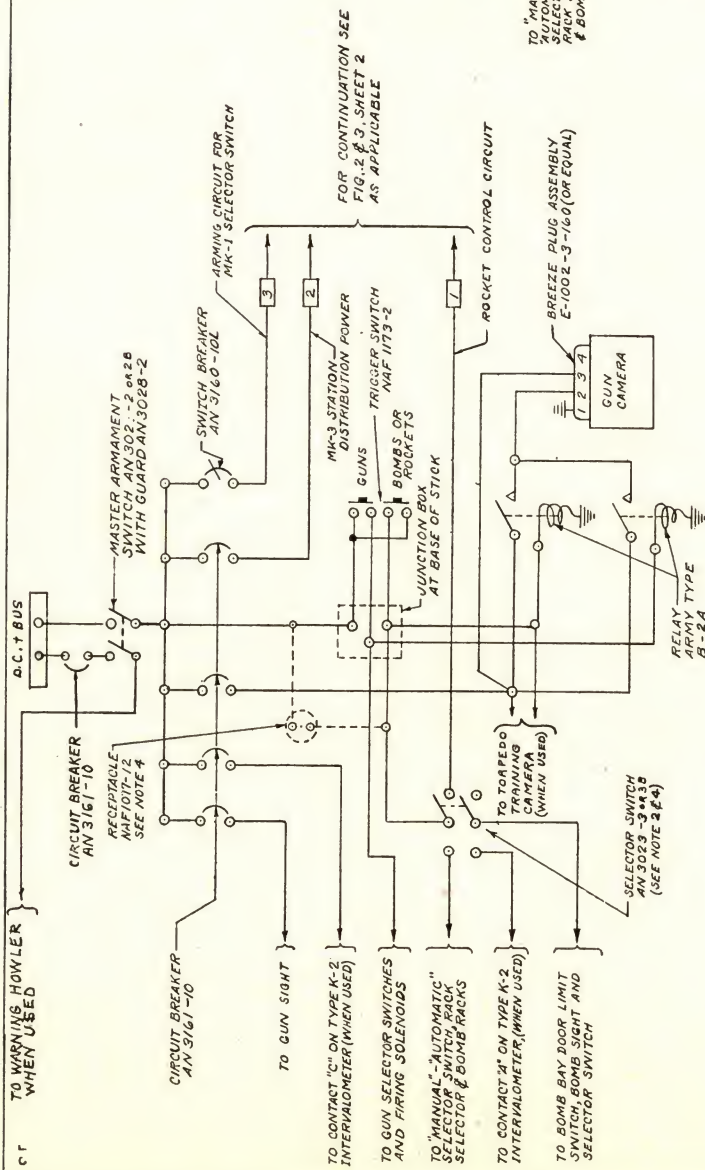
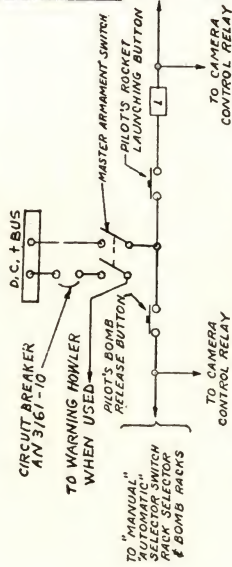


FIGURE 1.  
OF R-311-D



D	CHANGED BY: [initials] DATE: 12/1/81	[initials]	[initials]	[initials]	[initials]
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	ATTORNEYS			[initials]	[initials]

BUUREAU OF AERONAUTICS  
NAVY DEPARTMENT, WASHINGTON, D.C.  
WIRING DIAGRAM-ROCKETS



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OP 1239 (Prel.) CHANGE 1

16 May 1945

*M. R. Kelley*  
Acting

3 Pages — Page 1

ORDNANCE PAMPHLET 1239 (Prel.)

5'0 ROCKET (5'0 MOTOR, FIN STABILIZED)

is changed as follows:

GENERAL REVISIONS APPLICABLE TO ENTIRE TEXT

Substitute "Rocket Head" for "Rocket Body" whenever latter term appears in text. "Rocket Head" is the correct nomenclature. The complete round is now identified as the 5" Aircraft Rocket Mk 4 Mod 0.

CHANGES AND ADDITIONS TO TEXT ARE ON PAGES 2 TO 3

CHANGES IN FIGURES

Page 13

Change the number of Figure 4 to 3a

Add new Figures 4, 4a and 4b

Pages 19 and 20

Delete Figures 13 and 14

Substitute new Figures 13, 13a, 14 and 15

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